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Diffusion of Innovation, Knowledge Spillover and Economic Growth in the Regions of Kazakhstan

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This note evaluates the impact of innovation and knowledge spillovers on economic growth of regions in a transition economy. Despite skepticism about the innovative potential of transition economies, this study analyzes the importance of investments in research and development (R&D), technological innovation, education, the social economic environment, as well as spillovers.

The theory on diffusion of innovation was developed by Hagerstrand (*Innovation diffusion as a spatial process*. Chicago: University of Chicago Press, 1967). Articles on innovation and knowledge transfer (Romer, *Journal of Political Economy*, 1986; Grossman and Helpman, *The Journal of Economic Perspective*, 1994) informed the design of the theoretical framework for this research. Previous research suggests that knowledge spillovers have a significant effect on economic growth. Glaeser et al. (*Journal of Political Economy*, 1992) were the first to demonstrate the existence of an inverse relationship between distance and the spread of new ideas. Moreno et al. (*Environment and Planning*, 2005) studied spatial spillovers and innovation activity in Europe. Similar studies were conducted by Varga et al. (In Maier and Sedlacek, *Spillovers and Innovations*. 2005) for the United States.

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This study used data for Kazakhstan for the period 2005 through 2016 for all 14 regions and 2 large cities (Astana, the current capital and Almaty, the former capital). The data for these two cities were excluded from the data for their respective regions. The concept of a social filter was used to assess the innovative potential of a region. The social filter is a composite index, representing the integral level of human capital development and demographic structure of a region. In 1999, Rodríguez-Pose (*Growth and Change*, 1999) pointed out that areas characterized by a large percentage of younger people, people with higher education, and higher employment levels in high-tech industries have a higher potential for innovation. The social filter for Kazakhstan's regions was calculated using principal component analysis based on the unemployment rate, percentage of people employed in R&D, population under the age of 28, and share of industrial employment in the region.

The model used in this study is consistent with the traditional endogenous growth model with catch-up effect (Fagerberg, *Technical change and economic theory*, 1988). The dependent variable in the panel model is the growth rate of gross regional product (GRP) per capita. The set of independent variables includes the logarithm of GRP per capita, costs of R&D and technological innovation, education, health care as a percentage of GRP, the social filter and its flows, as well as investments in fixed capital as a percentage of GRP. The independent variables include indicators that have a direct impact on innovative development and knowledge spillovers between regions. GRP per capita was used in calculations with two lags. The remaining variables were used in calculations with one lag in order to eliminate the problem of simultaneity. Similar sets of independent variables were used in previous studies (Rodríguez-Pose and Villarreal, *Growth Change*, 2015; Kaneva and Untura, *Economic Change and Restructuring*, 2017). Two hypotheses were tested. Hypothesis 1: Costs of R&D and innovation, education, and health care have a significant and positive effect on growth. Hypothesis 2: Cost spillovers for R&D and innovation, education, and health care among regions have a significant and positive impact on growth.

The empirical part of the study was based on data from the Committee on Statistics of the Ministry of the National Economy of Kazakhstan for the period 2005 through 2016 (<http://stat.gov.kz/edition/publication/collection>. Assessed 04 January 2018). The fixed effects panel data model showed that costs of R&D and technological innovation, as well education costs as a share of GRP, had a significant positive effect on economic growth. Spillovers of R&D, technological innovation, and education also had a significant positive effect on the economic growth of regions. This is especially important for Almaty and Astana, the largest scientific and educational centers in the country.

The social filter was positively significant for regional economic growth. In contrast, the coefficient for the social filter spillover was negative. As the share of industrial employment was included in the social filter, the observed negative effect might have been caused by the outflow of the local labor force to other regions with a growing share of industrial employment. The coefficient for health care costs was insignificant. The impact of this factor simply cannot be captured within the estimated model framework due to the large time lags. The results of this study provide useful insights for economic policy, demonstrating that investments in innovative activity and education are especially important for developing economies, since both have a significant positive effect on the growth of regions.